

**Sharing the access to big
nuclear facilities for safety
training: experience of an
Erasmus intensive
programme**

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ERASMUS INTENSIVE PROGRAM

- Intensive course of at least 10 day
- 3 x 1 year support by the Erasmus-Socrates program
- Minimum 3 partners of 3 different countries
- grant covering approx.60%-70% of the expenses
- open only to the institutions of the partnership (may be modified every year)

Motivation

- Practical aspects are crucial in nuclear and radiological safety training, especially for large facilities (reactors, accelerators, ...).
- Many academic institutions active in the nuclear and radiological fields have little opportunities to organise practical training sessions on big facilities like reactors or accelerators
- Sharing the access to large equipment might be a part of the solution

The PAN course : evolution

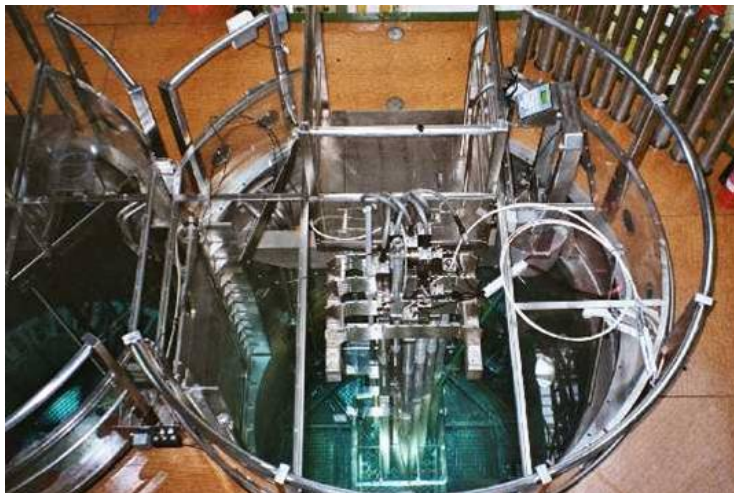
- Initially: 1-week practical course organised by CVUT Prague for TU Dresden and (2001) for ISIB Brussels
- Project extended to 2 weeks for submission as an IP by CVUT Prague, UPV Valencia and ISIB Brussels, accepted for 2002-2004
- Partnership extended to FH Aachen-Jülich and XIOS-HL Diepenbeek in 2003.
- PAN = “Practical approach to nuclear techniques”

The PAN course: main aspects

- Organised in Prague (2002, 2003) and Belgium (2004)
- again in Prague in 2005 (no EU grant)
- 2-weeks, ~ 60 h
- teaching language: English
- **Mostly practical:** only 10-12h of introductory lectures
- Includes practical work on large facilities
- ~ 20 h visits usually with practical demonstrations
- limited to 24 students, mostly at Master level (+ few doctoral students)
- Practical work in international subgroups, final synthesis in English prepared and presented by the students
- Open to all fields of application of nuclear/radiation techniques
- Emphasis on technical aspects, not safety aspects

PAN-Prague: reactors

- SPARROW: low-power pool reactor for training
 - activation flux measurement
 - delayed neutrons
 - void coefficient
 - reactivity of control rod
- Visit to research reactor in NRC Rez



PAN-Prague: accelerators

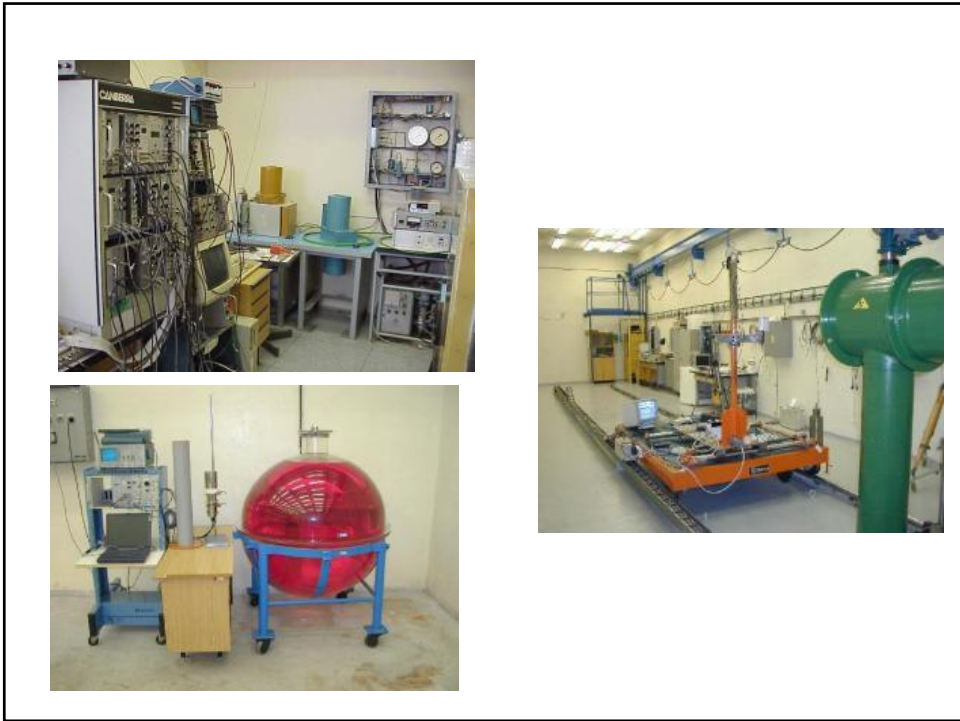
- Microtron : photon dosimetry
photonuclear reactions
activation analysis
- Medical LINAC :
dosimetric controls
- Visits to Van de Graaf
and cyclotron in
NRC Rez



PAN-Prague: specialised metrology

- Radon measurements
- γ -spectrometry
- XRFA
- Neutron spectrometry (Bonner spheres)
- Lyoluminescence
- Visit to Czech Metrology
Institute





PAN – Prague : other visits

- Leksell gamma-knife
- PET centre
- NPP Temelin (2002)
- Asterix laser facility (2005)
- Small Tokamak (2005)



PAN – Belgium : reactor

- BR1 reactor at SCK-CEN Mol

subcritical approach

period measurement

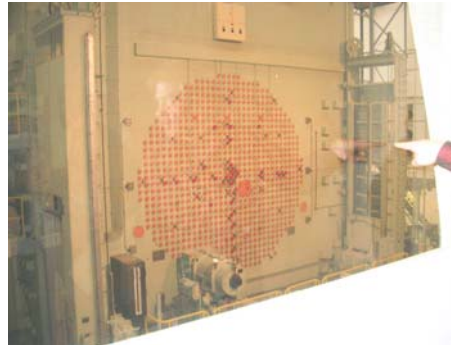
reactivity of control rod

temperature coefficient

activation flux measurement

fission chambers

diffusion length (Σ pile)



PAN – Belgium : accelerators

- Institute for reference materials and measurements
JRC-IRMM Geel

Gelina Linac :

TOF cross section experiment

Van de Graaf : proton telescope

- University of Liège

cyclotron: PIXE and RBS

- Medical LINAC

dosimetry controls



PAN – Belgium : specialised metrology

- Radon measurements
- α & γ spectrometry
- XRFA
- Thermoluminescence
- Environmental radioactivity
(Public Health Institute)
- Gamma-camera



PAN – Belgium : other visits

- Belgoprocess (radioactive waste management)
- HADES (underground lab. for geological disposal studies)



The SPERANSA project

- New Intensive Program accepted for 2006
- Same partnership
- Organised in Mol + Jülich, Feb. 2006
- **SPERANSA = « Stimulation of Practical Expertise in Radiological And Nuclear SAfety »**
- Same philosophy as PAN : **practical approach**, but
 - inclusion of exercises directly related to safety
 - analysis of safety aspects of the exercises
 - round tables on ethical aspects of nuclear safety and on sustainable development of nuclear techniques

SPERANSA **new exercises**

- In SCK-CEN Mol:
 - control of radioactive transport
 - work with hot cells
- In JRC-IRMM Geel
 - safety analysis
- In FH Jülich
 - radiochemical separation
 - neutron recoil spectrometry
 - neutron capture measurement
- In FZ Jülich
 - cyclotron: measurement of excitation function
 - Textor (fusion experiment)
 - γ dosimetry



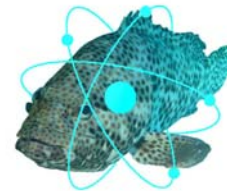
A few lessons

- Variety of student background: difficult to build an optimal program for all
- The program might be adapted for each national group, but this is contradictory to the wish to make them work in international subgroups.
- Successful international mixing
- Trigger for research cooperations
- Difficulty to accept more partners (max. 24 students)



The CHERNE network

- « CHERNE »
Cooperation for Higher Education in Radiological and Nuclear Engineering
- Started from the PAN/SPERANSA partnership
- Open network for the organisation of course modules or other activities at low cost for the students.
- Mutual recognition through Erasmus
- Still in early stage
- Workshop March 2006, Valencia
- www.upv.es/cherne



We warmly thank the many institutes that have cooperated to the PAN courses, among which:

- Nuclear research centre, Rez
- Czech Metrological Institute, Prague
- Homolka and Motol hospitals, Prague
- Czech Academy of Sciences, Prague
- NPP Temelin
- Nuclear research centre SCK-CEN , Mol
- Joint Research Centre - Institute for reference materials and measurements , Geel
- Public Health Institute, Brussels
- Cavell and St Jean hospitals, Brussels
- Belgoprocess
- University of Liège